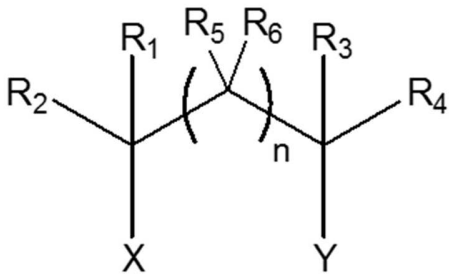
CLAIMS

1. A chemical mechanical polishing composition, comprising

1) at least one abrasive;

2) at least one compound of structure (I):

[Formula 1]



(I),

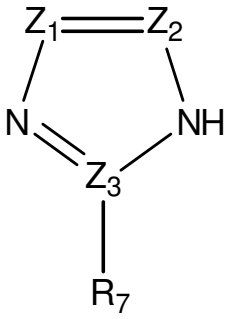
(in structure (I), n is 0, 1, 2, or 3;

each of X and Y, independently, is $O(R_a)$, $CH_2(R_a)$, or $NH(R_a)$, provided that at least one of X and Y is $O(R_a)$ or $NH(R_a)$, in which each R_a, independently, is H or C_1-C_2 alkyl optionally substituted by hydroxyl or NH_2, and

each of R_1-R_6, independently, is H, OH, or C_1-C_3 alkyl optionally substituted by OH or NH_2);

3) at least one compound of structure (II):

[Formula 2]



(II),

(in structure (II), each of Z_1 and Z_2, independently, is $-CR_8-$ or -N-, in which R_8 is H, $N(R_b)_2$, COOH, or C_1-C_3 alkyl; each R_b, independently, being H or C_1-C_3 alkyl; or Z_1 and Z_2 together form a 5-6 membered ring fused with the 5-membered ring in Structure (II);
Z_3 is -C- or -N-; and
R_7 is H, COOH, C_1-C_3 alkyl, or $N(R_9)_2$, in which each R_9, independently, is H or C_1-C_3 alkyl; provided that, when Z_3 is -N-, R_7 is deleted); and
4) water;
wherein the composition does not include tetramethylammonium hydroxide or a salt thereof and the composition has a polysilicon-to-silicon nitride removal rate ratio of at least 50:1.

2. The composition of claim 1, wherein the compound of structure (I) is an aminoalcohol.

3. The composition of claim 2, wherein the compound of structure (I) is selected from the group consisting of monoethanolamine, diethanolamine, 1-amino-2-propanol, 1-amino-2-butanol, 1,3-diamino-2-propanol, 3-amino-1,2-propanediol, 3-amino-1-propanol, 2-(2-aminoethoxy)ethanol, 2-amino-3-methyl-1-butanol, and 5-amino-1-pentanol.

4. The composition of claim 1, wherein the compound of structure (I) is a diamine.

5. The composition of claim 4, wherein the compound of structure (I) is selected from the group consisting of 2,2-dimethyl-1,3-propane diamine, 1,3-diaminopentane, and 2-(3-aminopropylamino)ethanol.

6. The composition of claim 1, wherein, when n is 0 and each of R_1-R_4 is H, at least one of X and Y is OH.

7. The composition of any one of claims 1 to 6, wherein the compound of structure (I) is in an amount of from 0.1 wt% to 15 wt% of the composition.

8. The composition of any one of claims 1 to 7, wherein the compound of structure (II) is an imidazole or a triazole.

9. The composition of claim 8, wherein the compound of structure (II) is selected from the group consisting of imidazole, 1,2,4-triazole, 3-amino 1,2,4-triazole, benzotriazole, 3,5-diamino-1,2,4-triazole, and 1,2,4-triazole-3-carboxylic acid.

10. The composition of any one of claims 1 to 7, wherein the compound of structure (II) is a tetrazole.

11. The composition of claim 10, wherein the compound of structure (II) is 5-(aminomethyl)tetrazole, 5-methyl-1H-tetrazole, 5-aminotetrazole, or a hydrate thereof.

12. The composition of any one of claims 1 to 11, wherein the compound of structure (II) is in an amount of from 0.1 wt% to 15 wt% of the composition.

13. The composition of any one of claims 1 to 12, wherein the abrasive is selected from the group consisting of alumina, fumed silica, colloidal silica, coated particles, titania, ceria, zirconia, and any combinations thereof.

14. The composition of claim 13, wherein the abrasive is colloidal silica.

15. The composition of any one of claims 1 to 14, wherein the abrasive is in an amount of from 0.05 wt% to 20 wt% of the composition.

16. The composition of any one of claims 1 to 15, further comprising a pH adjusting agent.

17. The composition of any one of claims 1 to 16, further comprising a salt containing a sulphonate group, an amino group, a carboxylate group, or a tetraalkylammonium group, the salt being different from a salt of tetramethylammonium hydroxide.

18. The composition of claim 17, wherein the salt is selected from the group consisting of amino acids, taurine, and choline hydroxide.

19. The composition of claim 17 or 18, wherein the salt is in an amount of from 0.05 wt% to 5 wt% of the composition.

20. The composition of any one of claims 1 to 19, further comprising an aminophosphonic acid.

21. The composition of claim 20, wherein the aminophosphonic acid is amino(trimethylenephosphonic acid).

22. The composition of claim 20 or 21, wherein the aminophosphonic acid is in an amount of from 0.01 wt% to 5 wt% of the composition.

23. The composition of any one of claims 1 to 22, wherein the composition has a pH of from 7 to 12.

24. The composition of any one of claims 1 to 23, wherein the composition does not include a bicarbonate salt or an oxidizing agent.

25. The composition of any one of claims 1 to 24, wherein the composition has a polysilicon removal rate of at least 8000 Å/minute.

26. The composition of any one of claims 1 to 25, wherein the composition has a polysilicon-to-silicon nitride removal rate ratio of at most 200:1.

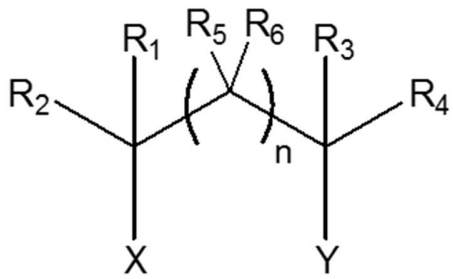
27. The polishing composition of any one of claims 1 to 26, wherein the composition is capable of being diluted at least two-fold at point of use (POU) before polishing, without deterioration in polishing performance when compared to the polishing composition before dilution.

28. A method for polishing a polysilicon film exposed on the surface of a wafer substrate, comprising treating the polysilicon film with the composition of any one of claims 1 to 27.

29. The method of claim 28, further comprising diluting the composition with deionized water prior to the polishing treatment step.

30. A chemical mechanical polishing composition, consisting of:
1) at least one abrasive;
2) at least one compound of structure (I):

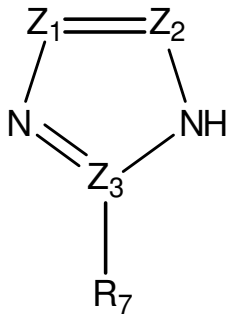
[Formula 3]



(I),

(in structure (I), n is 0, 1, 2, or 3;
each of X and Y, independently, is $O(R_a)$, $CH_2(R_a)$, or $NH(R_a)$, provided that at least one of X and Y is $O(R_a)$ or $NH(R_a)$, in which each R_a, independently, is H or C_1-C_3 alkyl optionally substituted by hydroxyl or NH_2, and
each of R_1-R_6, independently, is H, OH, or C_1-C_3 alkyl optionally substituted by OH or NH_2);
3) at least one compound of structure (II):

[Formula 4]



(II),

(in structure (II),

each of Z_1 and Z_2, independently, is $-CR_8-$ or -N-, in which R_8 is H, $N(R_b)_2$, COOH, or C_1-C_3 alkyl;

each R_b, independently, being H or C_1-C_3 alkyl; or Z_1 and Z_2 together form a 5-6 membered ring fused with the 5-membered ring in Structure (II);

Z_3 is -C- or -N-; and

R_7 is H, COOH, C_1-C_3 alkyl, or $N(R_9)_2$, in which each R_9, independently, is H or C_1-C_3 alkyl;

provided that, when Z_3 is -N-, R_7 is deleted);

4) at least one tetraalkylammonium salt, the at least one tetraalkylammonium salt being different from a salt of tetramethylammonium hydroxide;

5) at least one pH adjusting agent;

6) at least one amino acid; and

7) water.

31. The composition of claim 30, wherein the composition has a polysilicon-to-silicon nitride removal rate ratio of at least 50:1.

32. The composition of claim 30 or 31, wherein the composition has a polysilicon-to-silicon nitride removal rate ratio of at most 200:1.

33. The composition of any one of claims 30 to 32, wherein the composition has a polysilicon removal rate of at least 8000 Å/minute.

34. The composition of any one of claims 30 to 33, wherein the compound of structure (I) is an aminoalcohol.

35. The composition of claim 34, wherein the compound of structure (I) is selected from the group consisting of monoethanolamine, diethanolamine, 1-amino-2-propanol, 1-amino-2-butanol, 1,3-diamino-2-propanol, 3-amino-1,2-propanediol, 3-amino-1-propanol, 2-(2-aminoethoxy)ethanol, 2-amino-3-methyl-1-butanol, and 5-amino-1-pentanol.

36. The composition of any one of claims 30 to 33, wherein the compound of structure (I) is a diamine.

37. The composition of claim 36, wherein the compound of structure (I) is selected from the group consisting of 2,2-dimethyl-1,3-propane diamine, 1,3-diaminopentane, and 2-(3-aminopropylamino)ethanol.

38. The composition of any one of claims 30 to 33, wherein, when n is 0 and each of R_1-R_4 is H, at least one of X and Y is OH.

39. The composition of any one of claims 30 to 38, wherein the compound of structure (I) is in an amount of from 0.1 wt% to 15 wt% of the composition.

40. The composition of any one of claims 30 to 39, wherein the compound of structure (II) is an imidazole or a triazole.

41. The composition of claim 40, wherein the compound of structure (II) is selected from the group consisting of imidazole, 1,2,4-triazole, 3-amino 1,2,4-triazole, benzotriazole, 3,5-diamino-1,2,4-triazole, and 1,2,4-triazole-3-carboxylic acid.

42. The composition of any one of claims 30 to 39, wherein the compound of structure (II) is a tetrazole.

43. The composition of claim 42, wherein the compound of structure (II) is 5-(aminomethyl)tetrazole, 5-methyl-1H-tetrazole, 5-aminotetrazole, or a hydrate thereof.

44. The composition of any one of claims 30 to 43, wherein the compound of structure (II) is in an amount of from 0.1 wt% to 15 wt% of the composition.

45. The composition of any one of claims 30 to 44, wherein the abrasive is selected from the group consisting of alumina, fumed silica, colloidal silica, coated particles, titania, ceria, zirconia, and any combinations thereof.

46. The composition of any one of claims 30 to 44, wherein the abrasive is colloidal silica.

47. The composition of any one of claims 30 to 46, wherein the abrasive is in an amount of from 0.05 wt% to 20 wt% of the composition.

48. The composition of any one of claims 30 to 47, wherein the tetraalkylammonium salt is in an amount of from 0.05 wt% to 5 wt% of the composition.

49. The composition of any one of claims 30 to 48, wherein the composition has a pH of from 7 to 12.